

PATENT

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December 7, 2001

Date

Valerie Jones

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Hooper, et al.	Examiner: Not Yet Assigned
Application No.:	Not Yet Assigned	Art Unit: Not Yet Assigned
Filed:	Concurrently Herewith	Docket No.: 50225-8011.US02
For:	Methods for Fabricating Enclosed Microchannel Structures	

BOX PATENT APPLICATION

Assistant Commissioner for Patents
Washington, DC 20231

**PRELIMINARY AMENDMENT UNDER RULE 1.53b-1 CONTINUATION
APPLICATION**

Sir:

Prior to examination of the above-referenced Rule 1.53(b)-1 continuation application, the Examiner is respectfully requested to make the following amendments.

In the Specification:

Please delete the paragraph starting on page 1, line 4, and replace it with the following paragraph:

This application is a Continuation of Application Ser. No. 09/496,601, filed on February 2, 2000, which is a Continuation of Application Ser. No. 08/878,437, now U.S. Patent No. 6,176,962, filed on June 18, 1997, which is a Continuation-in-part of Ser. No. 08/853,661, filed May 9, 1997; and this application is a Continuation-in-part of Ser. No. 08/715,338, filed September 18, 1996; and this application is a Continuation-in-part of Ser. No. 08/690,307, filed

July 30, 1996, now U.S. Patent No. 5,770,029. The foregoing U.S. Patent Applications are hereby incorporated herein by reference in their entirety.

Please delete the paragraph starting on page 6, line 30, and replace it with the following paragraph:

The structures may take a variety of different shapes; they may, for example, be including disc-like or card-like, and they may be layered or laminated "sandwich" structures.

Representative shapes for such structures are further described in, for example, U.S. Patent Applications Serial Nos. 08853,661 and 08/715,338 and U.S. Patent Nos. 5,750,015 and 5,770,029.

Please delete the paragraph starting on page 7, line 15, and replace it with the following paragraph.

Both the base and cover substrates can be fabricated using any convenient methodology, such as molding, casting, extrusion sheet forming, calendaring, thermoforming, and the like.

Suitable base and cover substrates for use in the subject invention are further described in U.S. Pat. Applications Serial Nos. 08/853,661 and 08/715,338 and U.S. Patent Nos. 5,750,015 and 5,770,029.

Please delete the paragraph starting on page 8, line 8, and replace it with the following paragraph.

Base **12** has a planar surface **13** in which a microchannel structure is formed, including intersecting linear microchannels **21, 23**. At the ends of the channels holes **22, 24, 26, 28** are bored through, to provide reservoirs for fluids to be moved within the channels. Techniques for forming the microchannel structure in the base plate are disclosed, for example, in U.S. Patent Application Ser. No. 08/853,661. The microchannels as formed in the base plate are open, that is, absent a cover apposed to the channel-bearing surface **13** of the base plate, the microchannels are not fully enclosed.

Please delete the paragraph starting on page 17, line 12, and replace it with the following paragraph

In this Example, the experimental parameters and conditions for the electrophoresis separation and detection of the *Hae III* digest of Φ 174 RF DNA fragments under non-denaturing conditions were as in Example 3. Results of the separation using the PMMA/PDMS microchannel structures are shown in Fig. 8. In this Example, separation of the eleven double stranded fragments was achieved in 5.0 minutes of total separation time.

In the Claims:

Please cancel claims 1-13 without prejudice and add claims 14-26 as follows:

14. (New) A method for manufacturing a microfluidic device having a first and a second plastic substrate with substantially planar apposed surfaces, comprising:
 - apposing a planar surface of the first plastic substrate to a planar surface of the second plastic substrate, wherein the planar surface of the first plastic substrate includes microstructures;
 - heating the planar surface of the first plastic substrate above its glass transition temperature;
 - heating the planar surface of the second plastic substrate above its glass transition temperature; and
 - interfacing the heated planar surface of the first plastic substrate with the heated planar surface of the second plastic substrate bonding the plastic substrates and forming a leak proof enclosure of the microstructures.
15. (New) The method for manufacturing a microfluidic device of claim 14, wherein interfacing includes holding the substrates together under positive pressure.

16. (New) A method for manufacturing a microfluidic device; comprising:

apposing a planar surface of a first plastic substrate to a planar surface of a second plastic substrate, wherein the first plastic substrate has a glass transition temperature $Tg1$, and wherein the second plastic substrate has a glass transition temperature $Tg2$;

heating the planar surface of the first plastic substrate to a temperature greater than $Tg1$

heating the planar surface of the second plastic substrate to a temperature greater than $Tg2$; and

bonding thermally the planar surface of the first plastic substrate to the planar surface of the second plastic substrate.

17. (New) The method of claim 16, wherein the planar surface of the first plastic substrate includes microstructures.

18. (New) The method of claim 17, wherein bonding includes enclosing the microstructures.

19. (New) The method of claim 17, wherein bonding includes forming a leak proof enclosure of the microstructures.

20. (New) The method of claim 16, bonding includes placing the planar surface of the first plastic substrate in contact with the planar surface of the second planar substrate under positive pressure.

21. (New) The method of claim 16, wherein the first plastic substrate and the second plastic substrate have a bulk phase temperature of $T1$ and $T2$ respectively, and wherein heating includes keeping $T1$ less than $Tg1$, and wherein heating includes keeping $T2$ less than $Tg2$.

22. (New) There method of claim 17, wherein microstructures includes microchannels having cross sectional dimensions between about 1 μm and 500 μm .

23. (New) A method for manufacturing a microfluidic device; comprising:
 raising the local temperature of a planar surface of a first plastic substrate to a temperature in excess of the first plastic substrate's glass transition temperature, wherein the planar surface of the first plastic substrate includes microstructures;
 raising the local temperature of a planar surface of a second plastic substrate to a temperature in excess of the second plastic substrate's glass transition temperature;
 bonding the planar surface of the first plastic substrate to the planar surface of the second plastic substrate.

24. (New) The method of claim 23, wherein bonding includes forming a stable leak proof enclosure of the microstructure.

25. (New) The method of claim 24, wherein the microstructures include two or more microchannels that are fluidly connected.

26. A method for manufacturing a microfluidic device; comprising:
 apposing a planar surface of a first plastic substrate to a planar surface of a second plastic substrate, the first plastic substrate having a glass transition temperature T_{g1} and a bulk phase temperature $T1$, the second plastic substrate having a glass transition temperature T_{g2} and a bulk phase temperature $T2$, and wherein the planar surface of the first plastic substrate include microstructures, the microstructures having cross sectional dimensions between about 1 μm and 500 μm ;

heating the planar surface of the first plastic substrate to a temperature greater than T_{g1} , wherein $T1$ remains less than T_{g1} ;

heating the planar surface of the second plastic substrate to a temperature greater than Tg2, wherein T2 remains less than Tg2; and

bonding thermally the planar surface of the first plastic substrate to the planar surface of the second plastic substrate forming a leak proof enclosure of the microstructures.

Remarks:

This is a preliminary amendment to a Rule 1.53(b)-1 continuation application of co-pending parent application serial number 09/496,601, filed February 2, 2000. Note that the parent 09/496,601 has not been abandoned or issued.

In light of the foregoing preliminary amendment and remarks, the applicant requests reconsideration of the application and an allowance of all pending claims. If the Examiner wishes to discuss the above-noted amendment, or if the Examiner notices any informalities in the claims, the Examiner is encouraged to contact Michael Martensen by telephone at (650) 838-4406 to expediently correct any such informalities.

Respectfully submitted,

Perkins Coie LLP



Michael C. Martensen
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**APPENDIX – SPECIFICATION
MARKED TO SHOW CHANGES**

Paragraph starting on page 1, line 4:

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Attorney Docket No. 50225-8011.US.02

Patent

Transmittal of Continuation Patent Application for Filing

Certification Under 37 C.F.R. §1.10 (if applicable)

EF 279207985 US

"Express Mail" Label Number

December 7, 2001

Date of Deposit

I hereby certify that this application, and any other documents referred to as enclosed herein are being deposited in an envelope with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR §1.10 on the date indicated above and addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231

Valerie Jones

(Print Name of Person Mailing Application)



(Signature of Person Mailing Application)

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